

Claims

1. A method for segmenting image data, comprising:
identifying a pixel associated with a current frame of the image data;
defining a neighborhood of pixels around the pixel associated with the current frame, the defining including;
generating a three dimensional neighborhood;
comparing a distance between the pixel associated with the current frame and each pixel associated with the neighborhood of pixels to determine a smallest distance;
and
determining if the pixel associated with the current frame belongs to a current segment of the image data based upon the smallest distance.
2. The method of claim 1, wherein the method operation of determining if the pixel associated with the current frame belongs with a current segment of the image data includes,
establishing a threshold; and
comparing the threshold with the smallest distance, wherein if the smallest distance is less than the threshold then the pixel associated with the current frame belongs with the current segment.
3. The method of claim 1, wherein the method operation of generating a three dimensional neighborhood includes,
substituting a pixel value associated with a past frame pixel in place of a future pixel value of the current frame of the neighborhood.

4. The method of claim 1, wherein the three dimensional neighborhood includes two dimensions from the current frame and one dimension from a past frame.

5. The method of claim 1, wherein the method operations are completed in a single pass through the current frame of the image data.

6. A method for creating a summary of an audiovisual presentation, comprising:

segmenting a frame of the audiovisual presentation;

identifying a slide region of the segmented frame;

generating a histogram representing lines in the slide region; and

suppressing moving regions associated with successive frames from the histogram.

7. The method of claim 6, further comprising:

generating a histogram from a stored slide associated with the slide region; and

matching the histogram representing lines in the slide region with the histogram from the stored slide.

8. The method of claim 6, wherein the method operation of identifying a slide region of the segmented frame includes,

determining a shape ratio of the slide region.

9. The method of claim 6, wherein the method operation of generating a histogram representing lines in the slide region includes,

detecting edges of text and figures of the slide region; and

transforming data representing the edges into a parameter space.

10. The method of claim 6, wherein the method operation of suppressing moving regions associated with successive frames from the histogram includes,

capturing a foreground silhouette;

copying the foreground silhouette;

assigning the copied foreground silhouette a most recent timestamp; and

generating a motion mask, wherein edges located within the motion mask are excluded from the histogram.

11. The method of claim 6, wherein the method operation of segmenting a frame of the audiovisual presentation includes,

comparing each pixel value of the frame with neighbor pixel values in causal order.

12. The method of claim 11, wherein the neighbor pixel values include five neighbor pixel values.

13. The method of claim 12, wherein the five neighbor pixel values include two previous adjacent pixel values from the frame, a corresponding pixel value from a previous frame, and two adjacent pixel values from the previous frame.

14. A computer readable medium having program instructions for segmenting image data, comprising:

program instructions for identifying a pixel associated with a current frame of the image data;

program instructions for defining a neighborhood of pixels around the pixel associated with the current frame, the program instructions for defining including;

program instructions for generating a three dimensional neighborhood;

program instructions for comparing a distance between the pixel associated with the current frame and each pixel associated with the neighborhood of pixels to determine a smallest distance; and

program instructions for determining if the pixel associated with the current frame belongs to a current segment of the image data based upon the smallest distance.

15. The computer readable medium of claim 14, wherein the program instructions for determining if the pixel associated with the current frame belongs with a current segment of the image data includes,

program instructions for establishing a threshold; and

program instructions for comparing the threshold with the smallest distance, wherein if the smallest distance is less than the threshold then the pixel associated with the current frame belongs with the current segment.

16. The computer readable medium of claim 14, wherein the program instructions for generating a three dimensional neighborhood includes,

program instructions for substituting a pixel value associated with a past frame pixel in place of a future pixel value of the current frame of the neighborhood.

17. A computer readable medium having program instructions for creating a summary of an audiovisual presentation, comprising:

program instructions for segmenting a frame of the audiovisual presentation;

program instructions for identifying a slide region of the segmented frame;

program instructions for generating a histogram representing lines in the slide region; and

program instructions for suppressing moving regions associated with successive frames from the histogram.

18. The computer readable medium of claim 17, further comprising:

program instructions for generating a histogram from a stored slide associated with the slide region; and

program instructions for matching the histogram representing lines in the slide region with the histogram from the stored slide.

19. The computer readable medium of claim 17, wherein the program instructions for identifying a slide region of the segmented frame includes,

program instructions for determining a shape ratio of the slide region.

20. The computer readable medium of claim 17, wherein the program instructions for generating a histogram representing lines in the slide region includes,

program instructions for detecting edges of text and figures of the slide region; and

program instructions for transforming data representing the edges into a parameter space.

21. The computer readable medium of claim 17, wherein the program instructions for suppressing moving regions associated with successive frames from the histogram includes,

program instructions for capturing a foreground silhouette;

program instructions for copying the foreground silhouette;
program instructions for assigning the copied foreground silhouette a most recent timestamp; and
program instructions for generating a motion mask, wherein edges located within the motion mask are excluded from the histogram.

22. A system configured to capture and summarize an audiovisual presentation, comprising:

a recording device capable of capturing audio and video signals from the presentation; and

a computing device in communication with the recording device, the computing device having access to audiovisual data of the audiovisual presentation, the computing device including a slide segmentation module, the slide segmentation module configured to extract a slide region from a frame of the video signals according to a single pass color segmentation scheme.

23. The system of claim 22, wherein the recording device is a camcorder.

24. The system of claim 22, wherein the computing device includes a shot detection module, the shot detection module configured to compare edge information of the slide region for adjacent frames of the video signals.

25. The system of claim 24, wherein the shot detection module includes a motion suppression module, the motion suppression module configured to suppress artifacts caused by movements in front of the slide region.

26. The system of claim 22, wherein the slide segmentation module is further configured to compare a pixel value from a current frame with both adjacent pixel values from the current frame and adjacent pixel values from a previous frame, the adjacent pixel values from the previous frame corresponding to future pixel locations of the current frame.

27. The system of claim 22, wherein the slide segmentation module is further configured to create a 3 dimensional neighborhood for use in extracting the slide region, the three dimensional neighborhood including 2 dimensions in the current frame and one dimension in a previous frame.

28. A system configured to provide a real-time summarization of a meeting, comprising:

an image capture device configured to capture a presentation associated with the meeting;

a media server configured to receive captured presentation data from the image capture device, the media server having access to copies of presentation media used for the meeting, the media server further configured to generate summary data corresponding to the presentation from the captured presentation data, the summary data associated with presentation media transition points of the meeting; and

a client in communication with the media server, the client capable of receiving the summary data.

29. The system of claim 28, wherein the presentation media is a slide presentation.

30. The system of claim 28, further comprising:

a computing device in communication with the image capture device and the media server, the computing device including a slide segmentation module, the slide segmentation module configured to extract a slide region from a frame of the presentation according to a single pass color segmentation scheme, the computing device further including a shot detection module configured to compare edge information of the slide region for adjacent frames of the video signals, the shot detection module including a motion suppression module, the motion suppression module configured to suppress artifacts caused by movements in front of the slide region.

31. The system of claim 28, wherein the summary data is a table of contents having a presentation media transition point image associated with a corresponding copy of the presentation media.

32. The system of claim 28, wherein the presentation media transition point is associated with a time point of the meeting where a slide is changed.

33. An integrated circuit, comprising:

segmentation circuitry configured to segment a frame of image data into regions, the segmentation circuitry capable of identifying one of the regions as a slide region through analysis of a color characteristic and a shape characteristic associated with each of the regions; and

shot detection circuitry configured to identify a group of frames associated with the frame through analysis of edge information of the slide region with adjacent frames of the image data.

34. The integrated circuit of claim 33, further comprising:

template matching circuitry, the template matching circuitry configured to match a key frame representing the group of frames with an original slide region.

35. The integrated circuit of claim 33, wherein the shot detection circuitry further includes,

motion suppression circuitry configured to suppress artifacts caused by movements in front of the slide region.

36. The integrated circuit of claim 33, wherein the segmentation circuitry is further configured to define a 3 dimensional neighborhood for use in identifying the slide region, the three dimensional neighborhood including 2 dimensions in a current frame of the image data and one dimension in a previous frame of the image data.

37. The integrated circuit of claim 35, wherein the motion suppression circuitry includes,

circuitry for capturing a foreground silhouette;

circuitry for copying the foreground silhouette;

circuitry for assigning the copied foreground silhouette a most recent timestamp;

and

circuitry for generating a motion mask for excluding the artifacts.